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Hepatitis B Infection and Association with Other Sexually Transmitted Infections Among Men Who Have Sex with Men in Peru

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Abstract. To assess the epidemiology of hepatitis B virus (HBV) infection among men who have sex with men (MSM) in Peru, we evaluated the prevalence and associated risk factors for HBV serologic markers among participants of a HIV sentinel surveillance conducted in 2002–2003. The standardized prevalences for total antibodies to hepatitis B core antigen (anti-HBc) and hepatitis B surface antigen (HBsAg) were 20.2% and 2.8%, respectively. Individuals with human immunodeficiency virus (HIV-1) infection had significantly higher anti-HBc (44.3% versus 19.3%) and HBsAg (9.5% versus 2.3%) prevalences than uninfected men. Increasing age (adjusted odds ratio [AOR] = 1.06), versatile sexual role (AOR = 1.59), sex in exchange for money/gifts (AOR = 1.58), syphilis (AOR = 1.74), HIV-1 infection (AOR = 1.64), and herpes simplex virus type 2 (HSV-2, AOR = 2.77) infection were independently associated with anti-HBc positivity, whereas only HIV-1 infection (AOR = 3.51) and generalized lymph node enlargement (AOR = 3.72) were associated with HBsAg positivity. Pre-existing HBV infection is very common among Peruvian MSM and was correlated with sexual risk factors. MSM in Peru constitute a target population for further HBV preventive and treatment interventions.

INTRODUCTION

The burden of hepatitis B virus (HBV) infection continues to increase worldwide despite widespread awareness of preventive measures, including the availability of a safe and effective vaccine.[1] The World Health Organization estimates that 2 billion people worldwide have serologic evidence of past or present HBV infection, and 360 million people are chronically infected and at-risk for HBV-related liver disease.[2] Most of these people are in the developing world where intermediate (2–8% and 15–40%) to high (> 8% and > 40%) endemic areas (based on prevalence of hepatitis B surface antigen [HBsAg] and total antibodies to hepatitis B core antigen [anti-HBc], respectively) have been recognized, mostly reflecting people becoming horizontally infected during childhood through mechanisms not fully understood. In almost all Amerindian communities of the Amazon Basin and certain areas of the Andes in Peru, high rates of chronic HBV infection have been described[3–5] with associated high morbidity and mortality rates.[6–10]

Persons with chronic HBV infection (defined as those with serologic evidence of HBsAg for a period of at least 6 months) are the major reservoir for transmission, although any HBsAg-positive person is potentially infectious.[1] Hepatitis B virus is efficiently transmitted by sexual contact,[11,12] and sex partners of chronically infected persons have been shown to have a higher prevalence of HBV infection than control populations that included household (non-sexual) contacts with infected persons.[13]

In Peru, both human immunodeficiency virus (HIV-1) and sexually transmitted infections (STI) have disproportionately affected men who have sex with men (MSM), in whom high rates of HIV-1, STI, and risky sexual behavior have been reported in major urban and populated cities.[14] In this setting, injecting drug use (IDU) is largely uncommon, and HBV transmission is largely facilitated by high-risk sexual behavior.

The epidemiology of HBV infection, as it is related to risky sexual behavior, HIV-1 infection, or STI, has not been well-defined among MSM in Peru. A better understanding of the magnitude and risk factors for HBV infection among MSM is necessary to better formulate appropriate intervention strategies for its control. We assessed the prevalence and associated risk factors for past HBV infection among participants of a second generation HIV-1 sentinel surveillance conducted among MSM of six major urban cities during the period of October 2002 through March 2003.

MATERIALS AND METHODS

Study population and procedures. Between October 2002 and March 2003, during a 3-month period at each city, we conducted a cross-sectional sentinel surveillance survey in six different Peruvian cities: Lima, Sullana, Piura (coast), Arequipa (highlands), Iquitos and Pucallpa (Amazon jungle, endemic for HBV infection). Men who were at least 18 years of age and who had sexual intercourse with at least one man during the previous year were eligible to participate.[14] Study protocol, informed consents, and recruitment materials were approved by the National Acquired Immunodeficiency Syndrome and Sexually Transmitted Disease Control Program, Ministry of Health of Peru and the Asociacion Civil Impacta Salud y Educacion Institutional Review Board. Participants provided written informed consent for participation, HIV and STI testing, specimen storage for further testing, and/or contact for further studies. Testing for serum HBsAg, total anti-HBc, and hepatitis B virus e antigen (HBeAg) was conducted among survey participants who agreed to specimen storage for further testing.

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Comparable sampling strategies were used in all cities. Recruitment and referral of participants were based on snowball techniques and outreach by peer educators representing diverse MSM subcultures in different cities at previously mapped venues. At each sentinel site, counselors explained the study objectives to potential participants and obtained informed consents. Participants underwent a structured computer-assisted self-interview about demographics, risky sexual behavior, previous HIV-1 testing and diagnosis, current HIV-1 treatment, self-designated sexual identity, sexual role, number and sex of sexual partners, and sexual practices. Given the expected low-level or nonexistence of HBV information, no questions about previous HBV preventive vaccination coverage, surgery, blood transfusion, unsafe injection, tooth extraction, intravenous catheterization, piercing, bloodletting, or tattooing were asked. Study physicians performed medical histories and targeted physical examinations. All participants received confidential pre- and post–HIV-1 and STI test counseling, risk-reduction counseling, and condoms as well as sexually transmitted disease (STD) syndromic management when indicated.

Laboratory procedures. Serum antibodies to HIV-1 (enzymatic immunoassay [EIA], Vironostika; Organon Teknika, Durham, NC and Western blot; Biorad Laboratories, Hercules, CA), *Treponema pallidum* (rapid plasma reagin [RPR]; Organon Teknika, Durham, NC and micro-haemagglutination assay [MHA-TP]; Organon Teknika, Durham, NC), and Herpes Simplex Virus Type 2 (HSV-2) (EIA; Focus Technology, Cypress, CA) were tested in all survey participants. Syphilis seroreactivity was defined by an RPR titer ≥ 1:1 and a positive MHA-TP. A presumptive diagnosis of early syphilis was made for an RPR titer ≥ 1:16 with confirmatory MHA-TP. HSV-2 seroreactivity was defined by an EIA with an index ratio > 3.5.

Among survey participants who agreed to specimen storage and future testing of samples, serum HBsAg (Hepanostika HBsAg Ultra; BioMerieux, Inc., Durham, NC) and total anti-HBc (Hepanostika anti-HBc Uni-Form; Biomerieux, Boxtel, The Netherlands) were analyzed by EIA, whereas HBeAg was tested by microparticle enzyme immunoassay (HBe 2.0 Abbott Axym Systems; Abbott, Wiesbaden, Germany) among HBsAg-positive participants.

Statistical analysis. Univariate analyses of selected variables were performed by χ^2 and Fisher's exact tests for categorical variables and Mann–Whitney *U* tests for continuous variables. Multivariate analyses to predict independent factors associated with HBV infection were performed using a backward, stepwise hierarchical logistic regression model approach where only variables found to be significant ($P < 0.02$) in the univariate analyses were included. These analyses yielded univariate odds ratios (OR) and adjusted OR (AOR) with associated 95% confidence intervals (95% CI). All reported *P* values represent two-sided tests of significance. Statistical analyses were performed using Intercooled Stata 7.0 for Windows 98/95/NT (Stata Corp., College Station, TX).

RESULTS

Of 3,280 MSM participating in the sentinel surveillance, 2,703 (82.4%) consented to specimen storage and future testing of samples. All of them had samples available for HBsAg testing, and 2,683 (99.3%) had samples for anti-HBc testing. Compared with men consenting to specimen storage, non-consenting men were more likely to be from Lima than from other cities, be older, report higher education level, report symptoms of STI in the preceding year, practice commercial sex work, be either of an anal receptive or versatile nature (both anal receptive and insertive) in their sexual role, and have more known HIV-1–positive male sex partners and fewer female sex partners in the preceding 3 months as well as sustain higher antecedent HIV-1 and HSV-2 infection (data not shown).

Overall, the crude anti-HBc and HBsAg prevalences were 22.3% and 3.2%, respectively. Age- and HIV-standardized prevalences of 20.2% and 2.8%, respectively, were noted (Table 1). The prevalence of HBV serologic markers differed by city and HIV-1 serostatus; in general, HIV-1-infected men had significantly higher prevalences of anti-HBc and HBsAg (Table 2). Serologic evidence of HBeAg was documented in 15 (34.1%) of 43 HBsAg-positive men with available samples and was also found to be significantly higher among 13 HIV-1–infected (61.5%) compared with 30 HIV-1–uninfected (23.3%) men ($P = 0.034$).

Selected demographic and sexual behavior characteristics of men under study are described in Table 3. Of note, only 17 (0.6% of the total study participants) of 92 men with previous HIV-1 positive tests were receiving any type of antiretroviral treatment (no details about the kind of treatment were obtained). Only three men reported any type of IDU behavior in the preceding 3 months. A direct, age-related increase in anti-HBc seroprevalence was noted, being lowest (10.9%) among those 20 years of age or less and highest (46.3%) among those 41–50 years of age ($P < 0.001$; χ^2 test for trend) (Figure 1).

Men with anti-HBc positive results were more likely to be older, report lower educational level, self-identify as

TABLE 1
Hepatitis B serological markers among MSM participating in the 2002–2003 HIV sentinel surveillance

	Total anti-HBc						HBsAg					
			Crude prevalence		Standardized prevalence*				Crude prevalence		Standardized prevalence*	
	N	*n*	%	95% CI	%	95% CI	*N*	*n*	%	95% CI	%	95% CI
All cities	2,683	599	22.3	20.7, 23.9	20.2	18.7, 21.8	2,703	87	3.2	2.6, 3.9	2.8	2.2, 3.6
Sullana	467	72	15.4	12.1, 18.7	13.7	10.1, 16.4	468	8	1.7	0.5, 2.9	1.8	0.7, 2.8
Piura	272	31	11.4	7.6, 15.2	9.3	6.2, 12.4	273	6	2.2	0.4, 3.9	3.1	0.7, 5.6
Lima	918	243	26.5	23.6, 29.3	23.7	21.2, 26.3	933	38	4.1	2.8, 5.3	3.0	2.0, 4.1
Arequipa	433	46	10.6	7.7, 13.5	9.1	6.8, 11.3	436	10	2.3	0.9, 3.7	2.0	1.1, 2.9
Iquitos	307	88	28.7	23.6, 33.8	27.6	23.5, 31.6	307	15	4.9	2.5, 7.3	4.7	2.7, 6.8
Pucallpa	286	119	41.6	35.9, 47.4	39.2	34.3, 44.0	286	10	3.5	1.4, 5.6	2.9	1.1, 4.7

Anti-HBc = antibodies to hepatitis B core antigen; HBsAg = hepatitis B surface antigen; *N* = number of participants tested; *n* = number of participants positive; % = percentage; 95% CI = 95% confidence interval.
* Standardized by age and HIV-1 serostatus.

TABLE 2
Hepatitis B serological markers among MSM participating in the 2002–2003 HIV sentinel surveillance by HIV-1 status

	Total anti-HBc								HBsAg							
	HIV-1 status								HIV-1 status							
	Negative				Positive				Negative				Positive			
	N	*n*	%	95% CI	*N*	*n*	%	95% CI	*N*	*n*	%	95% CI	*N*	*n*	%	95% CI
All cities	2,360	456	19.3	17.7, 20.9	323	142	44.3*	38.9, 49.7	2,365	55	2.3	1.7, 2.9	338	32	9.5*	6.3, 12.6
Sullana	422	57	13.5	10.2, 16.8	45	15	33.3†	19.0, 47.7	423	2	0.5	0.0, 1.1	45	6	13.3*	3.0, 23.7
Piura	258	28	10.9	7.0, 14.7	14	3	21.4‡	0.0, 46.0	258	4	1.6	0.0, 3.1	15	2	13.3§	0.0, 32.8
Lima	735	156	21.2	18.3, 24.2	183	87	47.5*	40.2, 54.8	736	20	2.7	1.5, 3.9	197	18	9.1*	5.1, 13.2
Arequipa	404	36	8.9	6.1, 11.7	29	10	34.5*	16.1, 52.9	407	5	1.2	0.2, 2.3	29	5	17.2*	2.6, 31.9
Iquitos	273	69	25.3	20.1, 30.5	34	19	55.9*	38.3, 73.5	273	14	5.1	2.5, 7.8	34	1	2.9‡	0.0, 8.9
Pucallpa	268	110	41.0	35.1, 47.0	18	9	50.0‡	24.4, 75.6	268	10	3.7	1.4, 6.0	18	0	0.0‡	NA

Anti-HBc = antibodies to hepatitis B core antigen; HBsAg = hepatitis B surface antigen; *N* = number of participants tested; *n* = number of participants positive; % = percentage; 95% CI = 95% confidence interval.
* $P < 0.001$.
† $P = 0.002$.
‡ Non-significant difference.
§ $P = 0.037$.
The comparison between HIV-1 infected and uninfected men, respectively.

homosexuals or transvestites, practice commercial sex work, and report being mainly either of an anal receptive or versatile nature in their sexual role. There were no differences in the proportion of men reporting STI symptoms in the preceding year, although symptoms of anal abnormalities, including warts (4.7% versus 2.3%; $P = 0.005$), spontaneous secretion (3.4% versus 1.3%; $P = 0.002$), spontaneous bleeding (3.9% versus 2.1%; $P = 0.022$), spontaneous pain (3.4% versus 1.3%; $P = 0.003$), and bleeding during sex or defecation (8.2% versus 4.1%; $P < 0.001$) were more frequently reported at screening, as well as more frequently evidenced during physical examination, including warts (4.9% versus 2.4%; $P = 0.004$), spontaneous secretion (2.9% versus 1.3%; $P = 0.013$), and hemorrhoids (7.9% versus 3.1%; $P < 0.001$). More male and less female sex partners (including less female partners with HIV-1–negative and unknown HIV status) in the last 3 months were significantly reported by these men (Table 3). There were no differences in the types of partnership (primary, occasional, or one-night stand) or in the partner-specific sex behavior (insertive or receptive and protected or unprotected anal intercourse) established with up to the preceding three sex partners (data not shown) with the exception of insertive anal intercourse, which was less frequently reported by anti–HBc-positive men (37.8% versus 43.9%; $P = 0.008$).

HBsAg-positive men were more likely to identify themselves as transvestites, report being engaged in commercial sex work (Table 3), and report sustained rectal bleeding or discharge during the previous year (13.3% versus 5.5%; $P = 0.007$). No differences in STI symptoms reported at screening by HBsAg status were noted (data not shown); however, a higher proportion of generalized lymph node enlargement (9.5% versus 2.2%; $P < 0.001$), anal warts (7.1% versus 2.9%; $P = 0.041$), and hemorrhoids (9.5% versus 4.0%; $P = 0.023$) were found at physical examination among HBsAg-positive men. No differences in the median number of male and female sex partners were observed. HBsAg-positive men also reported more frequent sex with HIV-1–positive partners (Table 3).

There were no differences in these data for participants who reported having traveled to other Peruvian cities or countries during the previous 12 months, including when they reported sexual behavior with men or women at these places. Additionally, there were no differences in terms of alcohol or drug use (including before or during sex) in the preceding 3 months, regardless of anti-HBc or HBsAg serostatus (data not shown).

HIV-1 infection, syphilis, and HSV-2 infection were also more frequently diagnosed among men with positive hepatitis B serologic markers (Table 3).

In the multivariate analyses and after adjustment by city of residence and educational level, serologic evidence of total anti-HBc was more likely to occur in those who were older, reporting versatile sexual role, receiving money/gifts in exchange for sex, and having a previous diagnosis of syphilis, HIV-1, or HSV-2 infection and less likely among those reporting having had sex with women in the preceding 3 months. Participants with HBsAg-positive results were also more likely to have findings of generalized lymph node enlargement at physical examination as well as an HIV-1 diagnosis (Table 4).

DISCUSSION

To our knowledge, this is the first study to examine the prevalence of and associated risk factors for pre-existing HBV infection among MSM in Peru, a population where IDU is almost non-existent. After standardization for age and city of residence, evidence of total anti-HBc, suggesting previous exposure to or infection by HBV, was noted in one-fifth of study participants, whereas only 2.8% of them had results suggesting either an acute, resolving, or chronic stage (HBsAg seropositivity). Older age, versatile sexual role, receiving money/gifts in exchange for sex, syphilis, HIV, and HSV-2 infection were independently associated with total anti-HBc, characteristics which suggest HBV acquisition by sexual exposure. The prevalence of anti-HBc also increased significantly with age, reaching a peak at age 50, also supporting sexual exposure as the predominant mode of HBV acquisition. HIV infection and generalized lymph node enlargement were associated with HBsAg seropositivity in this study, which has a biologic correlate with decreased HBV clearance mechanisms as consequence of HIV-induced immunodeficiency. In particular, among non-Amazon jungle cities, the prevalence of HBV markers found in this study seems to be higher than those observed in the general population based on studies conducted in young pregnant women and blood donors.[15]

This study is also the first to provide objective and quantifiable information on the prevalence of HBV serologic markers

TABLE 3
Selected demographics and sexual behavior characteristics of MSM participating in the 2002–2003 HIV sentinel surveillance tested for hepatitis B markers

		Total anti-HBc			HBsAg		
	All participants	Positive	Negative		Positive	Negative	
Characteristic	*N* = 2,703	*N* = 599	*N* = 2,084	*P*	*N* = 87	*N* = 2,616	*P*
Age in years, median (IQR)	24 (20–30)	28 (23–36)	23 (20–28)	< 0.001	25 (21–31)	24 (20–30)	NS
Education level							
Less than high school	308 (11.6%)	98 (16.8%)	208 (10.1%)		8 (9.6%)	300 (11.6%)	
High school	1,592 (59.8%)	326 (55.8%)	1,251 (60.8%)		58 (69.9%)	1,534 (59.5%)	
Some college or graduate college	761 (28.6%)	160 (27.4%)	598 (29.1%)	< 0.001	17 (20.5%)	744 (28.9%)	NS
Sexual orientation							
Heterosexual	276 (10.2%)	30 (5.1%)	243 (11.9%)		8 (9.6%)	268 (10.4%)	
Bisexual	938 (35.4%)	118 (20.2%)	815 (39.8%)		20 (24.1%)	918 (35.7%)	
Homosexual	1,438 (54.2%)	436 (74.7%)	990 (48.3%)	< 0.001	55 (66.3%)	1,383 (53.8%)	NS
Transvestite	389 (14.6%)	143 (24.5%)	241 (11.7%)	< 0.001	20 (24.1%)	369 (14.4%)	0.018
Main sexual role							
Insertive	1,132 (42.6%)	131 (22.4%)	994 (48.4%)		28 (33.7%)	1,104 (42.9%)	
Receptive	1,095 (41.2%)	324 (55.5%)	763 (37.1%)		38 (45.8%)	1,057 (41.0%)	
Both insertive and receptive	432 (16.2%)	129 (22.1%)	298 (14.5%)	< 0.001	17 (20.5%)	415 (16.1%)	NS
Money/gifts in exchange for sex	822 (30.9%)	205 (35.2%)	610 (29.7%)	0.013	27 (32.5%)	795 (30.9%)	NS
Sex worker	273 (10.3%)	94 (16.1%)	174 (8.5%)	< 0.001	16 (19.3%)	257 (10.0%)	0.015
Sexual behavior in preceding 3 months							
Sex with men, number of partners							
Median (IQR)	1 (1–3)	2 (1–4)	1 (1–3)	0.002	2 (1–5)	1 (1–3)	NS
0	317 (11.9%)	60 (10.3%)	253 (12.3%)		16 (19.3%)	301 (11.7%)	
1	1,046 (39.4%)	218 (37.3%)	820 (39.9%)		20 (24.1%)	1,026 (39.8%)	
2–3	679 (25.5%)	142 (24.3%)	534 (26.0%)		23 (27.7%)	655 (25.4%)	
4 or more	616 (23.2%)	164 (28.1%)	447 (21.8%)	0.004*	23 (27.7%)	593 (23.0%)	NS*
Sex with women, number of partners							
Median (IQR)	0 (0–1)	0 (0–0)	0 (0–1)	< 0.001	0 (0–1)	0 (0–1)	NS
0	1,657 (62.3%)	472 (80.8%)	1,171 (57.0%)		59 (71.1%)	1,598 (62.1%)	
1	491 (18.5%)	66 (11.3%)	423 (20.6%)		6 (7.2%)	485 (18.8%)	
2–3	334 (12.6%)	36 (6.2%)	296 (14.4%)		14 (16.9%)	320 (12.4%)	
4 or more	176 (6.6%)	10 (1.7%)	164 (8.0%)	< 0.001*	4 (4.8%)	172 (6.7%)	NS*
Sex with specific partners†							
Male HIV-positive partners	93 (3.5%)	28 (4.8%)	63 (3.1%)	NS	8 (9.6%)	85 (3.3%)	0.008
Male HIV-negative partners	1,080 (40.6%)	229 (39.2%)	845 (41.1%)	NS	29 (34.9%)	1,051 (40.8%)	NS
Male partners of unknown HIV status	1,338 (50.3%)	310 (53.1%)	1,017 (49.5%)	NS	41 (49.4%)	1,297 (50.4%)	NS
Female HIV-positive partners	40 (1.5%)	6 (1.0%)	32 (1.6%)	NS	2 (2.4%)	38 (1.5%)	NS
Female HIV-negative partners	425 (16.0%)	50 (8.6%)	373 (18.2%)	< 0.001	8 (9.6%)	417 (16.2%)	NS
Female partners of unknown HIV status	610 (22.9%)	62 (10.6%)	544 (26.5%)	< 0.001	16 (19.3%)	594 (23.1%)	NS
HIV-1 infection	338 (12.5%)	143 (23.9%)	180 (8.6%)	< 0.001	32 (36.8%)	306 (11.7%)	< 0.001
Syphilis	354 (13.1%)	175 (29.2%)	173 (8.3%)	< 0.001	19 (21.8%)	335 (12.8%)	0.022
Early syphilis	91 (3.4%)	34 (5.7%)	57 (2.7%)	0.001	5 (5.7%)	86 (3.3%)	NS
HSV-2 seroreactivity	1,228 (45.4%)	471 (78.6%)	744 (35.7%)	< 0.001	55 (63.2%)	1,173 (44.8%)	0.001

Anti-HBc = antibodies to hepatitis B core antigen; HBsAg = hepatitis B surface antigen; IQR = interquartile range; NS = non-significant difference.
* χ^2 test for trend.
† Up to the last three partners.

among HIV-1-infected MSM in Peru, which, in general does not differ from data observed in other high-risk settings.[16,17] Surprisingly, HIV-1-infected MSM living in Amazon river basin jungle cities had similar levels of HBsAg seropositivity as corresponding HIV-1–uninfected men, suggesting resolved HBV infection occurrences at earlier ages that may have preceded HIV infection or a lack of study power to detect such differences. Negligible rates of antiretroviral treatment coverage among HIV-1–infected participants by the time that this study was conducted do not seem to have affected the generalization of our observed prevalence.

Worldwide, homosexual men exhibit higher rates of HBV infection than most other at-risk groups such as commercial sex workers or heterosexual men. Indeed, high levels of HBV infection have been found in different MSM communities, and these levels have been associated with lifetime number of sexual partners, unprotected intercourse, HIV-1 infection, IDU behavior, and history of STI among other factors.[18–25] Given shared routes of transmission, high rates of active HBV infection among HIV-1–infected participants would have a detrimental impact on the epidemiology of HBV in the context of expected prolonged periods of infectivity based on high HBeAg prevalences.[26] Treatment targeting both active viruses would reverse this impact and improve health conditions of the affected population.[27]

Our study suffered from several limitations. First, its design did not permit us to differentiate between incident (acute) and chronic HBV infection through concurrent anti-HBc and HBsAg serologic testing, which would have had important implications to predict the burden of disease and subsequent

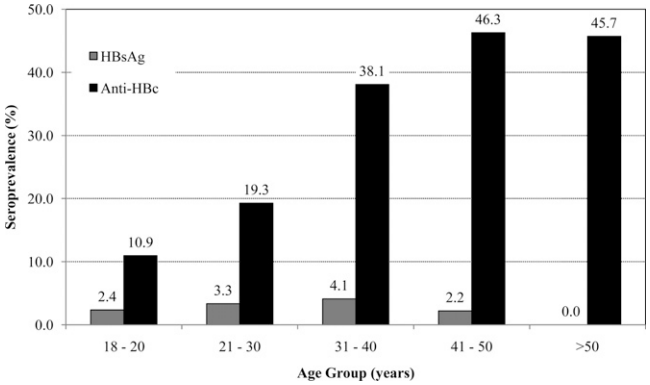

FIGURE 1. Seroprevalence of hepatitis B serologic markers by age group among 2,703 MSM in Peru from 2002 to 2003. Increasing seroprevalence by age group was found for total anti-HBc ($P < 0.001$; χ^2 test for trend). HBsAg = hepatitis B surface antigen; Anti-HBc = antibodies to hepatitis B core antigen.

management of complications (e.g., liver cirrhosis, hepatocellular carcinoma, etc.). This constitutes the main limitation of the study. If only 2.8% (95% CI = 2.2–3.6%) of the general MSM population, but not the HIV-1–infected subpopulation (9.5%; 95% CI = 6.3–12.6%), has an acute or resolving HBV infection based on HBsAg seropositivity, then the potential burden of disease would be lower than we might have thought; however, our study likely underestimated the prevalence of HBV serologic markers (and associated factors as well), because non-consenting participants for further testing from the parent study had higher risk behaviors and STI rates and were more likely to have had HBV serologic positive markers.

Second, although a large study on a nationwide basis, city-specific prevalence estimates could have been more accurately defined had there been larger sample sizes in certain cities; this would have allowed for more accurate prevalence estimates with narrow confidence intervals and more statistical power for the assessment of associated factors for HBV serologic marker positivity. Also, no analysis to assess the relationship with lifetime sexual exposure was conducted, because risk-behavior assessment was restricted to the preceding 3 months; however, HBV infection has been associated with both lifetime sexual exposure and risk behavior.[28]

Third, we did not obtain information regarding HBV preventive vaccination coverage or other important and often frequent modes of HBV acquisition, such as antecedent surgeries, blood transfusions, history of unsafe injections, tooth extractions, intravenous catheterization, piercing, bloodletting, or tattooing practices. Thus, accounting for these potential confounding variables could not be done. Lastly, the evaluation of the distribution of HBV genotypes and phylogenetic analysis of HBV strains was not performed because of funding limitations. This type of molecular genetic analysis among HBV-infected participants would have allowed us to much better estimate the severity of the HBV epidemic in this MSM population, where previously, genotype F was found to predominate.[29]

Since 2003, the Ministry of Health of Peru has been providing universal HBV vaccination to all children less than 1 year of age, and in 2008, they implemented a nationwide campaign targeting the population at large. However, populations at high risk for STI acquisition and/or transmission, such as MSM, have not been specifically targeted and deserve further special emphasis. Short-course vaccination regimens seem to reach acceptable coverage,[30,31] especially among mobile populations, like commercial sex workers[32] or groups with high rates of migration. Determination of HBV antibody levels after vaccination in HIV-1–infected patients may also be warranted given concerns of effectiveness.[33,34] Continued educational efforts, creation of environments that facilitate proper risk-factor evaluation and testing, and access to low-cost vaccine may facilitate vaccine uptake[35] in these populations. To increase acceptance, patients less health-motivated should be identified for pre-vaccination counseling,[36] and innovative means of ensuring completion of vaccination need to be developed.[37] It has been shown that hepatitis B vaccination can be integrated into STD clinic services with reasonable levels of vaccine acceptance and series completion.[38]

In summary, a high prevalence of HBV serologic markers suggesting previous exposure to or natural infection was found to be high among Peruvian MSM and was also found to be associated with high-risk sexual behavior, syphilis, HIV-1,

TABLE 4
Multivariate regression analysis of significant factors associated with hepatitis B serologic markers

Predictive logistic regression models	Crude			Adjusted		
	OR	95% CI	*P*	OR	95% CI	*P*
Anti-HBc*†						
Age (years)	1.07	1.06, 1.09	< 0.001	1.06	1.05, 1.08	< 0.001
Receptive sexual role	3.22	2.58, 4.03	< 0.001	1.27	0.93, 1.73	0.139
Both insertive and receptive sexual role	3.28	2.49, 4.33	< 0.001	1.59	1.11, 2.27	0.012
Received money/gifts in exchange for sex	1.28	1.06, 1.56	0.013	1.58	1.24, 2.02	< 0.001
Spontaneous anal pain at screening	2.62	1.44, 4.76	0.002	1.16	0.57, 2.35	0.687
Hemorrhoids evidenced at screening	2.72	1.82, 4.06	< 0.001	1.45	0.91, 2.33	0.120
Sex with women in the past 3 months	0.65	0.58, 0.73	< 0.001	0.90	0.81, 0.99	0.032
Insertive anal intercourse with up to the last three partners	0.77	0.64, 0.93	0.008	1.03	0.82, 1.30	0.798
HIV-1 infection	3.32	2.60, 4.23	< 0.001	1.64	1.21, 2.22	0.001
Syphilis	4.56	3.60, 5.77	< 0.001	1.74	1.31, 2.32	< 0.001
HSV-2 seroreactivity	6.63	5.35, 8.22	< 0.001	2.77	2.09, 3.66	< 0.001
HBsAg*						
Generalized lymph node enlargement at screening	4.64	2.13, 10.09	< 0.001	3.72	1.45, 9.57	0.006
HIV-1 infection	4.39	2.80, 6.90	< 0.001	3.51	2.06, 5.99	< 0.001

OR = odds ratio; anti-HBc = antibodies to hepatitis B core antigen; HBsAg = hepatitis B surface antigen.
*Adjustment made by city of residence and educational level.
†Factors significantly associated remaining in the model after adjustment.

and HSV-2 infection, suggesting sexual contact as a main mode of transmission. Given the potential likelihood of HBV acquisition and transmission, MSM in Peru constitute a target population for further HBV preventive interventions. These should include STI screening and treatment, effective and affordable programs for HBV vaccine delivery for susceptible individuals, and risk-reduction counseling and/or treatment of chronically infected individuals. Tracking the dynamic of the epidemic in non-intervened MSM at-risk groups is needed to continue to monitor trends in incidence and changes in circulating genotypes that may be of relevance in terms of treatment strategies. In the context of high rates of co-infection in this setting, HBV testing needs to be a priority among HIV-1–infected MSM to more appropriately lead the selection and monitoring of antiretroviral treatment schemes.

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